Alcatel·Lucent

Alcatel-Lucent 7450 ESS

ETHERNET SERVICE SWITCH | RELEASE 9.0

The Alcatel-Lucent 7450 Ethernet Service Switch (ESS) is a market-leading MPLS-enabled Carrier Ethernet platform dedicated to line-rate Ethernet service delivery at maximum scale. This high-performance platform provides Carrier Ethernet service aggregation with industry-leading throughput, densities, and reliability. Enabling a broad service mix and a graceful migration to a converged service environment, the 7450 ESS is the platform of choice to enable wide-scale Carrier Ethernet adoption, implementation, and transformation.

The Alcatel-Lucent 7450 ESS is the industry's most advanced MPLS-enabled Carrier Ethernet platform. With multi-terabit capacity, leading port densities, advanced MPLS capabilities, and best-in-class service attributes, all in a highly reliable and feature-rich platform, the 7450 ESS is a field-proven, highly scalable platform designed to support residential triple play services, business VPN services and mobile backhaul applications at the Carrier Ethernet service edge. The 7450 ESS integrates the scalability, resiliency and predictability of MPLS, along with the bandwidth and economics of Ethernet, to enable a metro-wide, converged packet aggregation infrastructure using Carrier Ethernet to deliver next-generation services.

With the flexibility to support both advanced Ethernet and IP services, the MEF-certified Alcatel-Lucent 7450 ESS allows customers to evolve their networks forward to create revenue-expansion opportunities while simultaneously protecting previous investments. Advanced Ethernet service delivery includes both point-to-point and any-to-any business VPN services, such as virtual private LAN services (VPLS) or Ethernet LAN (ELAN) services, Ethernet access to IP VPNs, virtual leased line (VLL) or Ethernet Line (E-Line) services, and Ethernet access to enhanced Internet services. As well, advanced IP services (either IPv4- or IPv6-based) including IP VPNs, Internet Access, IP multicast routing, and more can be offered via the 7450 ESS. Similar Ethernet or IP-based services may also be offered for the aggregation of residential triple play and mobile traffic over IP/MPLS infrastructures.

Supporting service speeds up to 100 Gb/s with advanced features fully enabled and no sacrifice in performance, the 7450 ESS delivers two terabits of capacity, enabling seamless evolution from 10 Gigabit Ethernet (10GigE) to 100GigE and widely scalable Carrier Ethernet metros. Additionally, with the industry's most advanced Provider Backbone Bridges/Virtual Private LAN Service (PBB/VPLS) implementation, customers have the flexibility to deploy either native Carrier Ethernet or MPLS-based services and functions in any combination.

Leveraging the carrier-optimized and highly fault-tolerant Service Router Operating System (SR OS) — a common element across the Alcatel-Lucent Service Router portfolio — the 7450 ESS provides advanced, highly flexible service-aware QoS, and a robust and feature-rich operations, administration and maintenance (OAM) toolkit to enable next-generation service delivery. For increased service intelligence, the 7450 ESS features a Multiservice Integrated Service Adapter (MS-ISA) to provide high-performance Layer 3 through Layer 7 application-specific processing, for the monetization and optimization of advanced residential triple play and business VPN services. This combination helps the 7450 ESS set a new market benchmark for the delivery of advanced services with predictable, differentiated service level agreements (SLAs). As one element of a broad data networking portfolio, the 7450 ESS can be deployed with Alcatel-Lucent's flagship 7750 Service Router and 7210 Service Access Switch families for end-to-end IP/MPLS networking solutions unmatched by the competition.

Features

Multi-terabit capacity

More end users per residential subscriber, emerging business applications extremely bursty in nature, and the wide proliferation of wireless devices using multimedia content — it all adds up to more bandwidth demand on the network and more capacity required. The Alcatel-Lucent 7450 ESS delivers multi-terabit switching capacity to meet these ever-increasing bandwidth requirements in Carrier Ethernet and IP/MPLS networking environments. Leveraging breakthrough in-house developed FP2 silicon, the 7450 ESS provides a migration path to multi-terabit system capacity with 100 Gb/s (full duplex) slots on existing systems — without a forklift upgrade. Supporting up to two terabits of throughput (half duplex) in one-third of a telco rack, the 7450 ESS enables providers to fully utilize its 100 Gb/s (full duplex) slot capacity with no tradeoff between terabit performance and service delivery.

Advanced Carrier Ethernet and IP services delivery

Designed as a service delivery platform, the 7450 ESS enables a broadly scalable service offering based upon MPLS-enabled Carrier Ethernet. Comprehensive Carrier Ethernet and IP/MPLS feature and protocol support allows a full complement of residential, business and mobile service applications across a range of topologies, from point-to-point to any-to-any, from fully meshed to ring-based. The 7450 ESS enables providers to flexibly offer any combination of Ethernet or IP-based services as individual network requirements dictate. With a market-leading PBB/VPLS solution, as well as support for BGP-based VPLS, service providers have a highly scalable Ethernet-based solution that can support hundreds of thousands of end users in a metro area with ease. The 7450 ESS also supports the ability to offer advanced IP services as well, leveraging service routing technology and capabilities from the 7750 SR platform. This helps protect investments and allows full asset utilization for existing Ethernet services, while creating revenue expansion opportunities via the ability to offer new IP services. The result is more choices and greater flexibility.

Additionally, service specialization capabilities can be offered using the integrated Alcatel-Lucent MS-ISA for the 7450 ESS platform. The MS-ISA supports a number of services including Application Assurance, leveraging deep packet inspection (DPI) technology to provide application-level traffic reporting and traffic management capabilities, and advanced video services (Fast Channel Change/Retransmission). With on-board high-performance Layer 3 to Layer 7 application-specific processing within the 7450 ESS platform, greater opportunity exists to capitalize on high-touch service opportunities and drive additional revenues.

High-density service aggregation

The 7450 ESS supplies a market-leading range of high-density, flexible Ethernet and SONET/SDH interface options, enabling cost-effective Carrier Ethernet service delivery and aggregation. With a full complement of 10M/100M/1GigE/10GigE interfaces with SFP/XFP/copper support (and including digital diagnostics monitoring support), the 7450 ESS can support up to 2880 GigE ports/rack or up to 360 10GigE ports/rack. Synchronous Ethernet (SyncE) support is also provided on MDA-XP interfaces. SONET/SDH MDAs are available to support legacy environments (OC-3c/STM-1c, OC12-c/STM-4c and OC-48c/STM-16c). Other interface options include a 10GigE MDA with integrated tunable DWDM optics and a high-scale MDA for residential applications. With the ability to mix-and-match interface types at the IOM level and/or between chassis, the 7450 ESS provides outstanding flexibility to fit any application.

Best-in-class availability

More than ever before, customers are demanding "always-on" services. High availability must go beyond simply implementing redundant hardware. In addition to redundant common equipment and line-card redundancy, the 7450 ESS provides an industry-leading and field-proven feature set that minimizes service disruption. Non-stop routing, non-stop services, stateful failover capabilities, in-service software upgrades (ISSU), and innovative multi-chassis LAG and Automatic Protection Switching (APS) enable the 7450 ESS to deliver superior service resiliency. Support for standards-based Ethernet APS (ITU-T G.8031 and G.8032 Ethernet) delivers carrier-grade reliability in point-to-point as well as ring topologies. Further, the 7450 ESS supports a wide variety of service assurance and availability monitoring tools across IP, MPLS, and Ethernet domains, including Fast Reroute, Graceful Restart Helper mode, MPLS-TE Graceful Shutdown, Bidirectional Forwarding Detection, and pseudowire redundancy, to name several. In short, with a comprehensive suite of high

availability features, the 7450 ESS is the industry's most reliable platform for offering non-stop Carrier Ethernet and IP/MPLS applications and services.

Proven end-to-end operating system

Alcatel-Lucent SR OS is a carrier-grade, highly fault-tolerant, and feature-rich operating system that operates across the entire Alcatel-Lucent Service Router portfolio. With a single operating system across the 7450 ESS and 7750 SR switch and router product families, operators can be assured of consistent service definitions and reliable operations and management when deploying Ethernet (VLL, VPLS), IP/MPLS (IP VPN), and/or mobile services and applications on an Alcatel-Lucent network.

Advanced, flexible Hierarchical QoS

With today's Ethernet and IP/MPLS traffic streams encompassing a variety of services consisting of video applications, voice, best-effort Internet access, and mission-critical business services, QoS becomes a critical element for delivering both best-effort and SLA-based services on a common platform. The Alcatel-Lucent 7450 ESS sets the standard with its advanced and highly flexible Hierarchical QoS implementation, providing hardware support for multi-tiered shaping and policing hierarchies. With service- and network-level queuing, granular shaping, policing, and marking of service traffic, and per-service guarantee capabilities, the 7450 ESS provides the tools to define and deliver the most stringent SLAs for high-value, differentiated services.

Robust service-aware management and OAM suite

Alcatel-Lucent provides a comprehensive element-, network-, and service-management solution for the 7450 ESS family. Tightly integrated with SR OS OAM tools, the 5620 Service Aware Manager (SAM) delivers comprehensive operations capabilities across network and service management domains, providing visibility into the network for small- and large-scale service deployments. Additionally, specialized management tools, including the 5650 Control Plane Assurance Manager (CPAM) and 5670 Reporting and Analysis Manager (RAM), work in conjunction with the 5620 SAM to streamline network operations and aid in the provisioning, fault management, and performance management of all advanced networking services.

This suite of management tools depends on the network elements themselves being appropriately instrumented to provide the required information, and the 7450 ESS supports extensive Ethernet OAM standards and capabilities. With support for ITU-T Y.1731 and IEEE 802.1ag, IEEE 802.3ah for first mile Ethernet OAM, Ethernet Local Management Interface (E-LMI), and the Alcatel-Lucent Service Assurance Agent, performance, connectivity, and fault monitoring is greatly simplified, so that even the most stringent SLAs can be met with confidence.

Benefits

Increased revenues with innovative, differentiated services

With market-leading PBB/VPLS and BGP VPLS implementations, Ethernet-based services using the Alcatel-Lucent 7450 ESS can be scaled to the highest levels — supporting more end users, more bandwidth, and more capacity, with no sacrifice in performance. The ability to provide IP-VPNs and other IP-based services allows revenue-expansion opportunities beyond Layer 2, Ethernet-only service environments. With an MS-ISA integrated into the 7450 ESS platform, opportunities can be capitalized on as they arise, whether it be short term, application-specific processing in a business service context, or a longer term video application in a residential service context. Lastly, with advanced Hierarchical QoS capabilities on the 7450 ESS, highly available and predictable services enable support of the highly stringent SLAs required to deliver advanced next-generation applications including video, IPTV, multimedia Internet, and premium business VPN services.

Ubiquitous services with massive scale and reach

The 7450 ESS provides a robust and proven MPLS-enabled Carrier Ethernet solution that allows Ethernet to be leveraged for its performance and economic benefits, while simultaneously leveraging IP/MPLS protocols and traffic engineering capabilities for efficient, reliable transport of any service or application and seamless integration with the IP/MPLS provider edge. This enables the consolidation of next-generation residential, business and mobile services on a single converged platform. VPLS/ELAN and VLL/E-Line services leverage MPLS to provide seamless Carrier Ethernet service reach over metro, national and international geographies. An innovative PBB/VPLS solution on the 7450 ESS platform enhances network and service scalability — both in terms of reach and MAC addressing — to support the expansion of Carrier Ethernet VPN services into new territories. Support for BGP-VPLS eases interworking and facilitates inter-provider communications.

High customer satisfaction with non-stop Carrier Ethernet

Broadband connectivity continues to grow exponentially, in wired as well as wireless environments. End users have voracious bandwidth appetites and little tolerance for services that are not always available. The high availability feature set of the 7450 ESS, including non-stop services, non-stop routing, ITU-T G.8031/G.8032 and FRR, enables a flawless quality of experience and promotes brand differentiation. All services (VLL, VPLS, enhanced Internet services) and applications are kept running and true stateful resiliency of IP routing and MPLS signaling protocols occurs during a control plane failure.

Dramatically improved return on investment (ROI)

With the flexibility of the 7450 ESS to enable a converged packet aggregation infrastructure using MPLS-enabled Carrier Ethernet for delivery of Ethernet- or IP-based services, networking is simplified and costs can be significantly

reduced. The 7450 ESS platform's multi-terabit system capacity with a proven "in-place" upgrade to 100 Gb/s (full duplex) per-slot capacity at highest levels of scalability provides unmatched investment protection. The interface density and variety, combined with high subscriber and service scale, allow for more subscribers per platform to further improve ROI without compromising performance and service quality.

Reduced operational costs with improved service assurance and service velocity

By enabling migration to a converged services environment — supporting the combination of wireline and wireless services on a 7450 ESS-based Carrier Ethernet metro network — operations and administration are simplified, because all services run over a platform with a consistent feature set, operational model, and management suite, while supporting the service scalability required. Legacy services and network domains can be decommissioned when practical, further simplifying overall network operations and expenditure. The tight integration of the 7450 ESS and 7750 SR operating system with the Alcatel-Lucent service and network management suite, including the 5620 SAM, 5650 CPAM, and the 5670 RAM, provides a unified operations solution that also reduces ongoing operational costs while enabling precise service-aware SLA control. Simplified service provisioning helps reduce mean-time-to-repair with rapid problem detection, isolation and prevention, and provides a fully integrated service-aware OAM tool kit for improved overall service availability.

Investment protection

Since its introduction, the 7450 ESS family has evolved with customer feature and scaling requirements. The 7450 ESS sophisticated and flexible hardware has a track record of allowing new features and enhancements to be introduced "in-place" in software, rather than through a rapid series of ever-changing hardware iterations. The award-winning FP2 network processing silicon ensures 7450 ESS platform capacity and service scale can continually evolve in step with customer requirements, providing an unprecedented level of investment protection.

Environmentally friendly

Alcatel-Lucent is committed to supplying environmentally friendly solutions. Pioneering advances in power efficiency are incorporated into the Alcatel-Lucent 7450 ESS product family, reducing the expense of both powering and cooling when comparing products with less advanced silicon technology. Combined with environmentally sensitive manufacturing processes, careful materials selection, and a view to sustainable product life cycle management, the 7450 ESS platform assists service providers in reducing their environmental impact while lowering operational costs.

Hardware overview

The Alcatel-Lucent 7450 ESS is available in five chassis — the 7450 ESS-12, ESS-7, ESS-6, ESS-6V, and ESS-1. With these five platform options, the 7450 ESS allows service providers, ILECs, multi-service operators, mobile operators, city carriers, application service providers, and industry and public sector (IPS) customers to build out cost-optimized, Carrier Ethernet infrastructures for a right-sized solution for any network environment. Each system offers leading throughput and density, as well as the ability to mix and match interface adapters, with exceptional portability across platforms. Table 1 provides a summary of the technical specifications for each platform within the family.

The Alcatel-Lucent 7450 ESS family supports a wide range of media and service adapters that are optimized to address different network and application requirements:

- *Input/Output Modules (IOMs)* – IOMs are supported on the 7450 ESS-12, 7450 ESS-7, and 7450 ESS-6/6V and are optimized for flexibility in deploying a variety of Carrier Ethernet- and IP-based applications. Each IOM supports up to two Media Dependent Adapters and can also be used to house Multi-Service Integrated Service Adapters. IOM3-XPs are the latest generation of IOMs featuring the Alcatel-Lucent FP2 network processing silicon.
- *Media Dependent Adapters (MDAs)* – MDAs are supported on all platforms and provide physical interface connectivity. MDAs are available in a variety of interface and density configurations. MDA-XPs are the latest generation of Ethernet MDAs and are notable for supporting the SyncE standard for the distribution of timing across Ethernet networks.
- *Integrated Media Modules (IMMs)* – IMMs are line cards providing integrated processing and physical interfaces on a single board. IMMs provide high-capacity, high-density Ethernet interfaces and are supported on the 7450 ESS-12, ESS-7, and ESS-6/6V platforms. IMMs also feature Alcatel-Lucent FP2 network processing silicon.
- *Multi-Service Integrated Service Adapters (MS-ISAs)* – MS-ISAs are resource modules that provide specialized processing and buffering for various applications. MS-ISAs are supported on the 7450 ESS-12, ESS-7 and ESS-6/6V platforms.

Refer to Tables 1 to 5 for further information regarding the different types of hardware, modules, and interfaces available for the 7450 ESS family.

Technical specifications

Table 1. Technical specifications for the Alcatel-Lucent 7450 ESS family

	7450 ESS-1	7450 ESS-6 AND 7450 ESS-6V	7450 ESS-7	7450 ESS-12
System throughput	• Switch fabric: Up to 40 Gb/s (half duplex) • MDA half-slot capacity: Up to 10 Gb/s (full duplex)	• Switch fabric: Up to 320 Gb/s (half duplex) • Slot capacity: Up to 40 Gb/s (full duplex)	• Switch fabric: Up to 1 Tb/s (half duplex) • Slot capacity: Up to 100 Gb/s (full duplex)	• Switch fabric: Up to 2 Tb/s (half duplex) • Slot capacity: Up to 100 Gb/s (full duplex)
IOM support	• One integrated IOM and SF/CPM	• IOM-20G • IOM3-XP • Up to 4 per chassis	• IOM-20G • IOM3-XP • Up to 5 per chassis	• IOM-20G • IOM3-XP • Up to 10 per chassis
Number of half-slot MDAs per chassis	• Up to 2 – Any mix of MDA or MDA-XP	• Up to 8 – Any mix of MDA or MDA-XP	• Up to 10 – Any mix of MDA or MDA-XP	• Up to 20 – Any mix of MDA or MDA-XP
Common equipment redundancy	• Power, fan	• SF/CPM, PEM-3, fan	• SF/CPM, PEM-3, fan	• SF/CPM, power entry module-3 (PEM-3), fan
Hot-swappable modules	• Integrated IOM and SF/CPM, MDAs and power	• SF/CPM, PEMs, fan, IOM, MDAs, MS-ISA	• SF/CPM, PEMs, fans, IOM, MDAs, MS-ISA	• SF/CPM, PEMs, fans, IOM, MDAs, MS-ISA
Dimensions	• Height: 6.7 cm (2.6 in.) • Width: 44.5 cm (17.5 in.) • Depth: 56.4 cm (22.2 in.)	ESS-6 dimensions: • Height: 35.56 cm (14 in.) • Width: 44.5 cm (17.5 in.) • Depth: 64.8 cm (25.6 in.) ESS-6V dimensions: • Height: 80 cm (31.5 in.) • Width: 46.5 cm (18.3 in.) • Depth: 45.5 cm (17.9 in.)	• Height: 35.56 cm (14 in.) • Width: 44.5 cm (17.5 in.) • Depth: 64.8 cm (25.5 in.)	• Height: 62.2 cm (24.5 in.) • Width: 44.5 cm (17.5 in.) • Depth: ¬ Without cable guides: 65.4 cm (25.75 in.) ¬ With cable guides: 76.5 cm (30.1 in.)
Weight	• 27.2 kg (60 lb) chassis weight	ESS-6: • Empty: 32.7 kg (72 lb) chassis weight with PEMS, two fan trays and air filters ESS-6V: • Empty: 54.4 kg (119.7 lb) chassis weight with PEMs, fan trays and air filters • Loaded: 89 kg (195.8 lb) approx.	• Empty: 27.2 kg (60 lb) chassis weight with two fan trays and air filters • Loaded: 70.5 kg (155 lb) approx.	• Empty: 33.1 kg (73 lb) chassis weight with two fan trays and air filters • Loaded: 152 kg (335 lb) approx.
Power	• 110 V AC or 220 V AC • -40 V DC to -72 V DC • 6 A to 10 A • 1+1 redundancy • AC available with external shelf	• -40 V DC to -72 V DC • 41 A to 75 A • 1+1 redundancy • AC options available	• -40 V DC to -72 V DC • 52 A to 93 A • 1+1 redundancy • AC options available	• -40 V DC to -72 V DC • 90 A to 162 A • 1+1 redundancy • AC options available
Cooling	• Side-to-side air flow	ESS-6: • Side-to-back air flow ESS-6V: • Front-bottom intake, rear top exhaust	• Side-to-back air flow	• Front-to-back air flow

Table 2. Alcatel-Lucent 7450 ESS MDA-XP and MDA support-by-chassis type

MDA TYPE	PORTS PER MDA	CONNECTOR TYPE	ESS-1	ESS-6/ESS-6V	ESS-7	ESS-12
ETHERNET MDA-XPs						
1000BASE	10/20	SFP	√	√	√	√
10/100/1000BASE-TX	20	RJ-45	√	√	√	√
10/100/1000BASE-TX	48	6 x mini RJ-21	–	√	√	√
10GBASE (LAN/WAN PHY)	1/2/4	XFP	√	√	√	√
ETHERNET MDAs						
100BASE-FX	20	SFP	√	√	√	√
10/100BASE-TX	60	5 x mini RJ-21	√	√	√	√
10GBASE/1000BASE (LAN PHY)	1+10	XFP/SFP	√	√	√	√
10GBASE (tunable optics)	1	LC	√	√	√	√
HIGH SCALE MDAs						
1000BASE	10	SFP	–	√	√	√
10GBASE	1	XFP	–	√	√	√
PoS MDAs						
OC-3c/STM-1c	16	SFP	√	√	√	√
OC-3c/OC-12c/STM-1c/STM-4c (multirate)	8/16	SFP	√	√	√	√
OC-48c/STM-16c	2/4	SFP	√	√	√	√
OTHER						
Versatile services module	N/A	N/A	√	√	√	√

Table 3. Alcatel-Lucent 7450 ESS IMM support-by-chassis type

IMM TYPE	PORTS PER IMM	CONNECTOR TYPE	ESS-1	ESS-6/ESS-6V	ESS-7	ESS-12
100GBASE	1	CFP	–	–	√	√
40GBASE	3	QSFP	–	–	√	√
10GBASE	12	SFP+	–	–	√	√
10GBASE	5/8	XFP	–	√	√	√
10/100/1000BASE	48	SFP	–	√	√	√
10/100/1000BASE	48	RJ-45	–	√	√	√

Table 4. ISA support-by-chassis type

ISA TYPE*	ESS-1	ESS-6/ESS-6V	ESS-7	ESS-12
Multiservice Integrated Services Adapter (MS-ISA)	–	√	√	√

* Consult the MS-ISA Data Sheet for details for application support on a given platform.

Table 5. 7750 SR MDAs supported within the 7450 ESS (when Advanced IP Services mode is enabled) by chassis type*

MDA TYPE	PORTS PER MDA	CONNECTOR TYPE	ESS-1	ESS-6/ESS-6V	ESS-7	ESS-12
PACKET OVER SONET/SDH MDA*						
OC-192c/STM-64c POS	1	Simplex SC	–	–	√	√
ANY SERVICE ANY PORT MDAs*						
Channelized DS3/E3 ASAP	4/12	1.0/2.3 connectors	–	–	√	√
Channelized OC-3/ STM-1 ASAP	4	SFP	–	–	√	√
Channelized OC-12/ STM-4 ASAP	1	SFP	–	–	√	√
CIRCUIT EMULATION SERVICE MDAs*						
Channelized OC-3/ STM-1 CES	1/4	SFP	–	–	- / √	√
Channelized OC-12/ STM-4 CES	1	SFP	–	–	√	√
ATM MDAs*						
OC-3c/STM-1c / OC-12c/ STM-4c (Multirate) ATM	4	SFP	–	–	√	√
OC-3c/STM-1c ATM	16	SFP	–	–	√	√

* Note that to operate these MDAs in a 7450 ESS chassis, Advanced IP Services mode is required

Safety standards and compliance agency certifications

Safety

- EN 60590-1
- IEC 60950-1 CB Scheme
- CSA/UL 60950-1 NRTL
- FDA CDRH 21-CFR 1040
- EN 60825-1
- EN 60825-1/2
- IEC 60825-1
- IEC 60825-2

EMC

- ICES-003 Class A
- FCC Part 15 Class A
- EN 300 386
- EN 55022
- EN 55024
- EN 61000-4-2
- EN 61000-4-3
- EN 61000-4-4
- EN 61000-4-5
- EN 61000-4-6
- EN 61000-4-11
- IEC CISPR22
- AS/NZS CISPR 22

Immunity

- EN 61000-3-2 Power Line Harmonics
- EN 61000-3-3 Voltage Fluctuations and Flicker
- EN 61000-4-2 Electric Static Discharge
- EN 61000-4-3 Radiated Immunity
- EN 61000-4-4 EFT
- EN 61000-4-5 Surge
- EN 61000-4-6 Low Frequency Common
- EN 61000-4-11 Voltage Dips and Sags

Telecom

- Telcordia GR-253-CORE, Issue 3
- IEEE 802.3 (Gigabit Ethernet, Ethernet)
- ANSI T1.105.03
- ANSI T1.105.06
- ANSI T1.105.09
- ANSI T1.403 (DS1)
- ANSI T1.404 (DS3)
- ITU-T G.957
- ITU-T G.825
- ITU-T G.824
- ITU-T G.823
- ITU-T G.813
- ITU-T G.707
- ITU-T G.703

Environmental

- ETS 300 019-1-1, Storage Tests, Class 1.2
- ETS 300 019-1-2, Transportation Tests, Class 2.3
- ETS 300 019-1-3, Operational Tests, Class 3.2
- ETS 300 019-2-4, per A 1 Seismic

Environmental specifications

- Operating temperature: 0°C to 40°C (32°F to 104°F)
- Relative humidity: 15% to 85% (non-condensing)
- Operating altitude: Sea level to 3048 m (10,000 ft)

Electronic equipment devices

- WEEE
- RoHS
- R&TTE
- China CRoHS

Certifications

- Network Equipment Building System (NEBS) Level 3
  - ¬ Telcordia GR-63-CORE, Issue 4, June 2006
  - ¬ Telcordia GR-1089-CORE, Issue 3, March 2006
  - ¬ ATT-TP-76200
- CE

Alcatel·Lucent